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ROCKY MOUNTAN SPOTTED FEVER IN CALIFORNIA*

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In 1906, Ricketts demonstrated the susceptibility of guinea-pigs to Rocky Mountain spotted fever by the injection of infected human blood. The fever, the duration of the disease, and the cutaneous phenomena, resembled closely these conditions as observed in man. During the same year, this investigator proved that the wood-tick (Dermacentor venustus) was the intermediate host of spotted fever.[1] McClintic[2] and Fricks[3] later made extensive investigations of this disease in the Rocky Mountain regions of the United States.

As a result of the work of Ricketts in the establishment of this disease as an entity, both by inoculation into guinea-pigs and by transmission experiments through ticks, it became possible to determine the area of prevalence of spotted fever throughout the western states, where it is now recognized that this seasonal disease has an irregular incidence. The occurrence of the disease in California has been recognized, as is shown by Kelly,[4] who collected the histories of 32 cases as having occurred in the last 14 years. It was not, however, until June, 1916, that the occurrence of this disease in California was established definitely by animal experimentation.

OXNARD CASE

On May 31, 1916, this bureau was called on to investigate a case of suspected typhus fever at Oxnard, Ventura County. The patient had been sick about 12 days. There had been some bronchial involvement, fever at times at 106, and pronounced coma. There was a maculopetechial eruption, which involved practically the entire body covering. The most extensive involvement was on the abdomen, thorax, and thighs. Figure 1, 15th day of illness shows the extent of the skin eruption. The recovery was gradual, extending over about 8 weeks, and complicated by extensive bedsores. No body lice were found on the patient or his clothing; furthermore, after his recovery it was learned that he had been bitten by a tick about 2 weeks before his illness.

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[1] Jour. Am. Med. Assn., 1906, 47, p. 358.

[2] Pub. Health Rep., 1912, 27, p. 732.

[3] Ibid., 1913, 28, p. 1647; 1915, 30, p. 15.

[4] California State Jour. Med., 1916, 14, p. 407.

Only a single tick could be obtained from the vicinity of the patient's home, and this proved to be the variety (Dermacentor venustus) responsible for the transmission of Rocky Mountain spotted fever.

Inoculations.—Eight c.c. of blood drawn from the patient were injected intraperitoneally in a rhesus monkey. Chart 1 shows a temperature curve of 10 days' duration in this animal. The fever remained high, there being noticeable remission only on the 2 days when the animal was anesthetized and bled. The termination was by crisis extending over about 36 hours. The slight fever following the crisis is accounted for by complications—necrosis and sloughing.

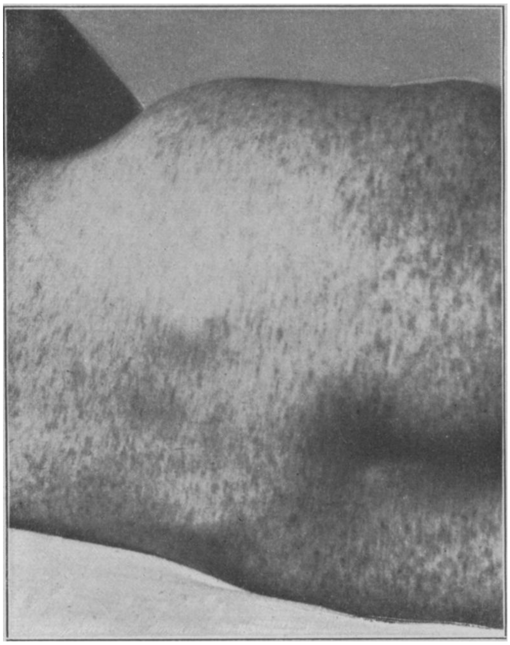


Fig. 1. Oxnard Case, showing maculopetechial eruption.

On the 7th day of illness, subcuticular hyperemic areas appeared on the face and ears; at this time these could be easily pressed out, and were only mildly congested areas of varying size. On the 10th day of illness, however, these lesions, as also lesions which appeared on the perineum and scrotum, had become petechial in character. Figure 2, taken after the crisis, shows the extent of the maculopetechial lesions of the face and ear.

The skin lesions of the left ear, scrotum, and left hind knee terminated in extensive necrosis and sloughing, and were slow in healing.

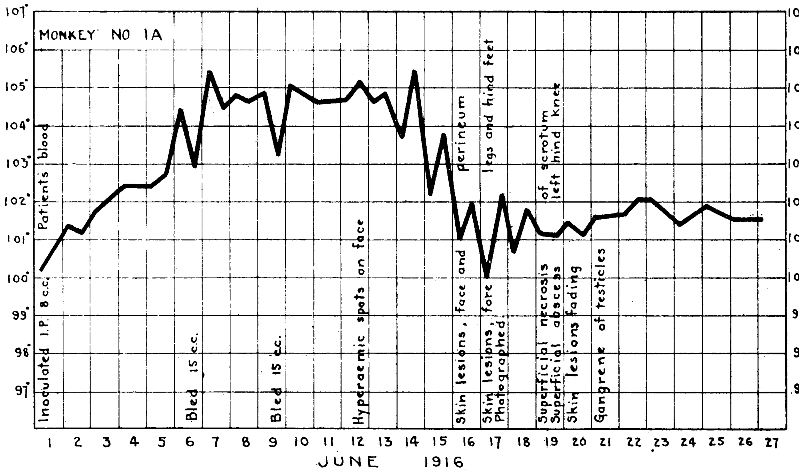
The necrosis of the scrotum and left hind knee was of considerable extent, the former covering two thirds of the scrotal area and involving the deeper subcutaneous tissues. This latter was an irregular area, 2.5 cm. in diameter, and involved only the superficial structures.

On the 1st day of fever, the monkey was bled from the heart, and 15 c.c of blood taken. The blood was defibrinated and 2 c.c. and 0.5 c.c. injected intraperitoneally into 2 male guinea-pigs, respectively. These animals both showed a temperature of over 104 on the 4th day. The curves ranged from 104 to 106 F. for 6 and 9 days, respectively, and terminated by crisis, followed by death. The scrotum of 1 was somewhat swollen on the 5th day of temperature. On each succeeding day, the inflammation became more marked, and at the time of death, on the 9th day, the edema was so extensive that the scrotum was 4 times its normal size. Aside from the general involvement of the scrotum, there were several macular spots which could be readily seen through the white skin, and which were readily obliterated by pressure. On postmortem, the only changes were a slight enlargement of the spleen, the axillary, and inguinal lymph nodes.

The 3rd generation of this strain of Rocky Mountain spotted fever in laboratory animals was established by transferring blood from the 2nd generation immediately on the appearance of fever. This—the Ventura County—strain of virus has been passed through 80 generations in guinea-pigs. It is now being maintained in ticks.

ROCKY MOUNTAIN SPOTTED FEVER, OXNARD, VENTURA CO. STRAIN.

INVESTIGATIONS OF BUREAU OF COMMUNICABLE DISEASES, CALIFORNIA STATE BOARD OF HEALTH.



The following conclusions may be drawn from a study of the records of these 80 passages:

The virulence of the virus could be increased or decreased depending on the relation of the time of transfer to the onset of fever. A temperature of 104 could be made to appear on the 2nd day, by transferring the blood of several successive generations on the 1st day of fever. By making the transfer late in the febrile stage, the incubation period could be prolonged 8-10 days. In 1 instance only was there a 17-day incubation period.

The more prolonged the incubation period, the more pronounced was the swelling of the scrotum or vulva. The swelling appeared about the 3rd day of fever and progressed rapidly. In white-skinned males, a generalized infiltration was noticeable in the scrotal covering, and this was often supplemented by macular spots, which also appeared on the feet. Postmortem revealed swelling and punctate hemorrhages in the lymph nodes, enlarged and cyanosed spleen.

By injecting a virus of low virulence the scrotal involvement could be made to appear in 100% of the animals.

The size of the dosage (0.5 c.c.-4.0 c.c.) did not influence the incubation period, except in the case of a generation of virus of low virulence. Such a virus required a large dose to produce infection.

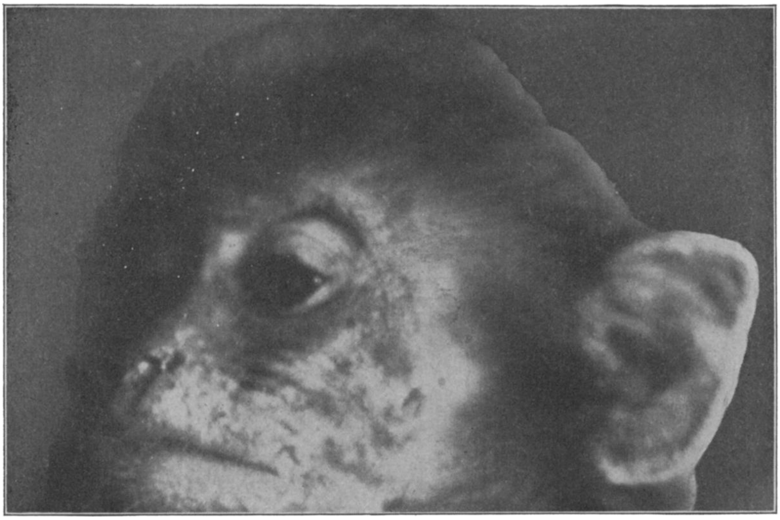


Fig. 2. Oxnard Strain of Virus in monkey, showing maculopetechial lesions of skin and necrotic area of nose.

PALO ALTO CASE

While the following case is included in the incidence of this disease in California, the history indicates that the infection took place in Nevada.

The patient had left his home in Palo Alto, April 30, 1917, for Rogers, Idaho. He remained there until May 3, at which time he traveled by team to Jarbage, Nevada. While making this journey it was necessary for the patient and other members of the party to cut sage brush to fill in almost impassable roads. In visiting the mines in and around Jarbage, he daily rode horseback. Although he contended he was exposed to tick bite only when cutting brush on the way to Jarbage, it must be remembered that ticks infest horses and his daily riding afforded opportunity for infection.

On returning from Jarbage to Rogers, May 11, the patient noticed a pimple on the skin over the sternum. This lesion probably represents the focus of infection, an infected tick having gained entrance through the opening of the shirt.

On May 12, at Rogers, the patient had chilly sensations, rapidly followed by flushed face and general sensation of fever, with intense pains in the muscles and bones, no appetite; and some nausea. On arriving at his home in Palo Alto, May 14, the aching of the bones became less severe, but an intense headache developed. At this time the temperature was 103, the respiration 18, the pulse 82. From this time there was a constant severe headache. The eruption appeared first on the inner surfaces of the thighs, May 16, 1917, and extended within 2 days to the entire body. The surfaces of the hands and feet were, however, not as extensively involved as the other surfaces. It will be noted that the order of appearance of the eruption in this case is the reverse to that of the usual case of spotted fever.

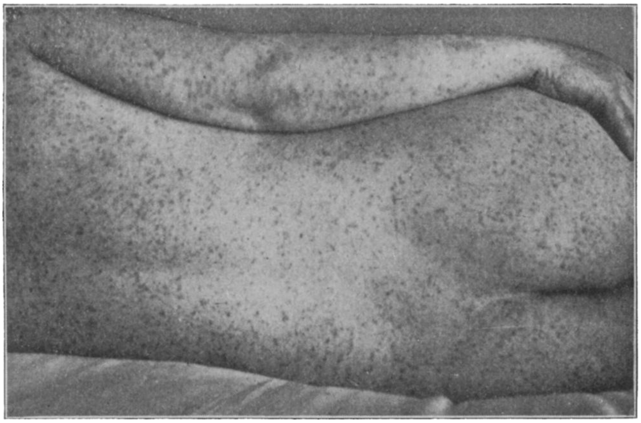


Fig. 3. Palo Alto Case; maculopetechial spots.

On the 3rd day of the eruptive stage there were both mulberry and maculopetechial spots. The new mulberry spots, representing hyperemic areas could be easily pressed out; while the mature maculopetechial spots, representing endarteritis and interstitial extravasations could not be pressed out. The mulberry spots were about 0.4 cm. in diameter, with irregular borders, not elevated, while the petechial spots, somewhat larger, varied 0.4-1.2 cm. and were irregular in outline and apparently somewhat elevated. The spots remained discrete and gave the body a speckled appearance (Figs. 3 and 4).

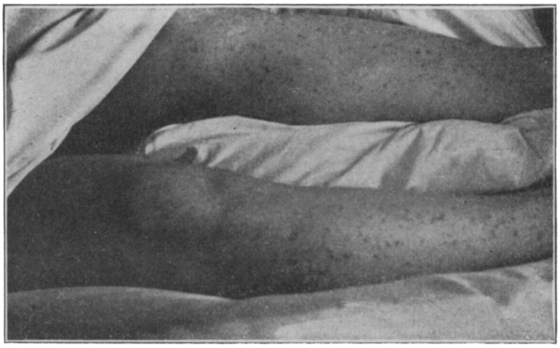


Fig. 4. Palo Alto Case; maculopetechial spots.

Neither the spleen nor the liver was palpable. Prior to the eruptive stage there was considerable albumin in the urine. This decreased in amount and finally disappeared about the 12th day of illness. The leukocyte count was slightly above normal. The patient was at all times conscious, although speech was labored. The eyes were somewhat injected and sensitive to light. The fever was at no time above 103, and it began to fall by crisis just prior to the appearance of the eruption. It is significant that the respiratory rate rose with the fall in temperature—a syndrome common in Rocky Mountain spotted fever.

On the whole it may be said that this was a mild case of Rocky Mountain spotted fever; the fever was not high and there were moderate daily remissions. The most prominent subjective symptoms were intense pains in the bones during the first 3 days, followed by severe continuous headache for 10 days. The large number of spots were somewhat out of proportion to the symptoms.

Inoculations.—May 20, 1917, 10 c.c. of blood were drawn from the median vein of the arm, and inoculated intraperitoneally in 2 male guinea-pigs, 2 c.c. and 0.5 c.c., respectively. May 26, the animal which received the larger dose showed some swelling of the scrotum. The following day the scrotum had enlarged to twice its normal size; the swelling was accompanied by hyperemia, which was not only general, but intensified in numerous small areas. At no time did the temperature in this animal rise much above normal, and had the temperature curve alone been relied on as an indication of infection, the changes in the scrotum might easily have been overlooked.

As this change in male guinea-pigs is a means of differentiating Rocky Mountain spotted fever from typhus fever, and as these 2 diseases are the only ones with which we are concerned in the diagnosis of the case in question, it may be definitely concluded that this case was one of Rocky Mountain spotted fever.

CONCLUSIONS

The results of animal inoculations in these cases definitely establish the occurrence of Rocky Mountain spotted fever in California.

The finding of Dermacentor venustus in Ventura County and the occurrence of a case there marks that region as a new area of possible prevalence of the disease in California.

Advantage should be taken of the inoculation test to establish definitely the nature of the seasonal eruptive fever which occurs in Modoc and Lassen counties.